

AMENDMENTS TO THE CLAIMS

The listing of claims below replaces all prior versions of claims in the application.

Claim 1 (Currently Amended): A ~~method for operating a~~ spin injection device comprising: which includes a spin injection part having a spin polarizing part and an injection junction part, and SyAF having a first magnetic layer and a second magnetic layer having different magnitudes of magnetization, and magnetically coupled together antiparallel to each other via a nonmagnetic layer, wherein said first magnetic layer of SyAF and said injection junction part are bonded, and said method comprising
injecting a spin polarization electron a spin polarization electron is injected from said spin injection part by flowing electric current between said spin polarizing part and said second magnetic layer, wherein magnetization of said first and second magnetic layers is reversed while maintained in antiparallel state without applying an external magnetic field, and wherein
said flowing electric current is 1 mA or less.

Claim 2 (Currently Amended): The ~~method of operating a~~ spin injection device as set forth in claim 1, wherein the injection junction part of said spin injection part is either a nonmagnetic conductive layer or a nonmagnetic insulating layer.

Claim 3 (Currently Amended): The ~~method of operating a~~ spin injection device as set forth in claim 1 or claim 2, wherein said spin polarization electron is capable of spin

conservation conduction or tunnel junction at the injection junction part of said spin injection part.

Claim 4 (Currently Amended): The ~~method of operating a~~ spin injection device as set forth in claim 1 or claim 2, wherein the spin polarization part of said spin injection part is a ferromagnetic layer.

Claim 5 (Currently Amended): The ~~method of operating a~~ spin injection device as set forth in claim 1 or claim 2, wherein the spin polarization part of said spin injection part is provided in contact with an antiferromagnetic layer that fixes the spin of a ferromagnetic layer.

Claim 6 (Currently Amended): The ~~method of operating a~~ spin injection device as set forth in claim 1 or claim 2, wherein the aspect ratio of the first and the second magnetic layers of SyAF in contact with the injection junction part of said spin injection parts is less than 2.

Claim 7 (Currently Amended): A ~~method of operating a~~ spin injection magnetic apparatus comprising: ~~which includes~~ a free layer having a first magnetic layer and a second magnetic layer coupled together magnetically antiparallel to each other via a nonmagnetic layer, and in which magnitudes of magnetization are different, and the magnetization of said first magnetic layer and said second magnetic layer is capable of magnetization reversal while maintaining the antiparallel state, and

a ferromagnetic fixed layer tunnel-junctioned with the first magnetic layer of said free layer via an insulating layer, wherein:

said ferromagnetic fixed layer and said free layer are made to be a ferromagnetic spin tunnel junction, and ~~said method comprising:~~

~~revising~~ the magnetization of said first and second magnetic layers is reversed by flowing electric current between said second magnetic layer of the free layer and said ferromagnetic fixed layer while maintained in an antiparallel state without applying an external magnetic field, and wherein said flowing electric current is 1 mA or less.

Claim 8 (Currently Amended): The ~~method of operating a~~ spin injection magnetic apparatus as set forth in claim 7, wherein said spin injection magnetic apparatus ~~[[it]]~~ is provided with, in addition to the above-mentioned aspects, a spin injection part having an injection junction part connected to said free layer and a spin polarization part.

Claim 9 (Currently Amended): The ~~method of operating a~~ spin injection magnetic apparatus as set forth in claim 8, wherein the injection junction part of said spin injection part is either a nonmagnetic conductive layer or a nonmagnetic insulating layer.

Claim 10 (Currently Amended): The ~~method of operating a~~ spin injection magnetic apparatus as set forth in claim 8 or claim 9, wherein a spin polarization electron is capable of spin conservation conduction or tunnel junction at the injection junction part of said spin injection part.

Claim 11 (Currently Amended): The ~~method of operating a~~ spin injection magnetic apparatus as set forth in claim 8 or claim 9, wherein the spin polarization part of said spin injection part is a ferromagnetic layer.

Claim 12 (Currently Amended): The ~~method of operating a~~ spin injection magnetic apparatus as set forth in claim 8 or claim 9, wherein the spin polarization part of said spin injection part is provided in contact with an antiferromagnetic layer that fixes the spin of a ferromagnetic layer.

Claim 13 (Currently Amended): The ~~method of operating a~~ spin injection magnetic apparatus as set forth in any one of claims 7, 8 or 9, wherein the aspect ratio of the first and the second magnetic layers of the free layer in contact with the injection junction part of said spin injection part is less than 2.

Claim 14 (Currently Amended): The ~~method of operating a~~ spin injection magnetic apparatus as set forth in claim 8 or claim 9, wherein said spin injection part is word line.

Claim 15 (Currently Amended): A ~~method of operating a~~ spin injection device ~~including~~ comprising:

a spin injection part having a spin polarization part including a ferromagnetic fixed layer and an injection junction part of a nonmagnetic layer,

a ferromagnetic free layer provided in contact with said spin injection part, and

a nonmagnetic layer provided on the surface of said ferromagnetic free layer, wherein:
said nonmagnetic layer of the injection junction part is made of an insulator or a
conductor, ~~said method comprising:~~ and

~~reversing~~ the magnetization of said ferromagnetic free layer by flowing electric current
between the spin polarization part and said nonmagnetic layer provided on the surface of said
ferromagnetic free layer in the direction perpendicular to the film surface without applying an
external magnetic field, and wherein said flowing electric current is 1 mA or less.

Claim 16 (Currently Amended): The ~~method of operating~~ a spin injection device as set
forth in claim 15, wherein said ferromagnetic free layer is made of Co or Co alloy, a
nonmagnetic layer provided on the surface of said ferromagnetic free layer is a Ru layer, and its
film thickness is 0.1 - 20 nm.

Claim 17 (Currently Amended): A ~~method of operating~~ a spin injection device ~~including,~~
comprising:

a spin injection part having a spin polarization part including a ferromagnetic fixed layer
and an injection junction part of a nonmagnetic layer, and

a ferromagnetic free layer provided in contact with said spin injection part, and
a nonmagnetic layer and a ferromagnetic fixed layer provided on the surface of said
ferromagnetic free layer, wherein:

said nonmagnetic layer of the injection junction part is made of an insulator or a
conductor, ~~said method comprising:~~

~~reversing~~ the magnetization of said ferromagnetic free layer is reversed by flowing electric current between the spin polarization part and the ferromagnetic fixed layer provided on the surface of said ferromagnetic free layer in the direction perpendicular to the film surface without applying external magnetic field, and wherein said flowing electric current is 1 mA or less.

Claim 18 (Currently Amended): The ~~method of operating a~~ spin injection device as set forth in claim 17, wherein said ferromagnetic free layer and said ferromagnetic layer are made of Co or Co alloy, a nonmagnetic layer provided on the surface of said ferromagnetic free layer is a Ru layer, and its film thickness is 2 - 20 nm.

Claim 19 (Currently Amended): ~~The method of operating~~ A spin injection magnetic apparatus wherein, said spin injection apparatus uses the spin injection device as set forth in any one of said claims 15 - 18.

Claim 20 (Currently Amended): ~~method of operating~~ A spin injection magnetic memory device, wherein the spin injection magnetic memory device uses the spin injection device as set forth in any one of said claims 15 - 18.

Claims 21-50 (Canceled)